How this investigation fits within the “Concept and Lesson Map”:

**Overview for Unit 1: Solids**

Solid materials have properties that separate them from other states of matter and maintain their shape regardless of their container.

Overarching question(s) for this whole investigation:

* What are the properties of solids?
* How do solids behave?

**Attending to “How People Learn”**

How People Learn Key Finding #1: Preconceptions

Eliciting Student Ideas:

Prior to beginning Investigation 1, give students the modified Formative Assessment Probe titled: “Is it a Solid?” Have a tray with each of the six objects at each group for students to pick up and investigate as they determine whether or not the object is a solid. Walk through the probe together, using a document camera if possible to show one of the probes, and encourage students to circle only answers **they** believe are more like the rocks (solid), not what their neighbor thinks. When the Investigation is complete, students will complete this probe again and compare their two responses, looking for changes in their thinking and trying to determine what events brought about those changes.

Common Student Preconceptions:

* Solid materials have properties that separate them from other states of matter and maintain their shape regardless of the container they are in. (Driver 2002)
* Something is only solid if it is hard (not soft or crumbly) (Driver 2002)
* Solidity is associated with hardness, strength and non-malleability (Driver 2002)
* Conversion of a bulk solid into a powdered solid or to a liquid is likely to result in a decrease in mass (Driver 2002)
* They also do not understand that all elements/molecules will go into any of the 3 states of matter depending on temperature. (WA Laser 2006)

How People Learn Key Finding #2: Facts/Concepts/Knowledge

WA State Content Standards “Science Domains” (EALR 4)

* K-1 PS2B Solids retain their shape regardless of the container they are in.

WA State Science Standards “Crosscutting Concepts and Abilities” (EALRs 1-3)

* K-1 SYSB Some objects can easily be taken apart and put back together again while other objects cannot be taken apart without damaging them (e.g., books, pencils, plants, and animals).
* K-1 INQD Scientsts report on their investigations to other scientists, using drawings and words.
* K-1 APPB Different materials are more suitable for some purposes than for other purposes

Key Understandings For the Teacher:

* Every substance can exist in a variety of different states, depending on temperature and pressure. When matter gets cold enough, atoms or molecules lock in place in a more or less orderly fashion as solids. (SFAA 1990)
* Solids are materials that have a more or less fixed shape. (Science Matters 1991)
* See “Background for the teacher” pg. 4 of Investigation 1 (FOSS)

How People Learn Key Finding #3: Metacognition

Metacognition: How did my thinking change? What caused the change? How did I come to believe this?

After completing Investigation 1, students should complete the “Is it a Solid” assessment probe, then review their initial ideas from the beginning of the investigation and reflect on how their ideas have changed. Students will need support for this kind of thinking, explicitly connecting back to their preconceptions and what events may have brought about those changes.

* Example: “Look back at your paper where you circled the things that are solid. Do you still agree with what you wrote, or do you need to show how your thinking has changed after we looked at solids together?”

**Suggested Assessments for Student Understanding:**

* While students are playing the sorting game in part 2, check to see if they are able to isolate one property and then sort objects by that property
* Part 3: the “30 second interviews” can be a good time to see what students understand. Asking the questions suggested by FOSS is a great place to start, but probe the kids a little more by asking follow up questions to see what they really understand about why certain properties of solids make them more suitable for specific jobs.

**Additional Information**

Materials and Student Management

* We use four of our five senses to get information about the world around us while in the classroom. Remind the students that **we never “taste” in science.**
* Part 1: Foss suggests a scripted introduction to solids in step 2. As the purpose of this part is to describe properties of solids, you may want to start by letting them explore the solids and asking them to help you generate a list of common attributes. After they have the list, you may want to give them the vocabulary: (for example:) “What are some things all these objects have in common? Objects that have most of these properties are called ‘solids.’” Then the kids have a set of criteria they can refer to (and add to or change) to help them determine whether or not an object is a ‘solid.’
* Part 2: This sorting game is very similar to “guess my rule” (from TERC2 Investigations math)
* Part 3: Read FOSS Science Story *Everything Matters* after completing part 3
* Interdisciplinary extensions: “My Book of Solids” may be more useful as “My book of Properties.” Students can draw a picture of a solid and write a property or descriptor of that object (something that is on the list of attributes of solids.) Consider using the mini sentence strips “This solid is \_\_\_\_\_.”
* Consider setting up a station for sorting solids or using the construction materials during a choice or center time.

Timing Considerations